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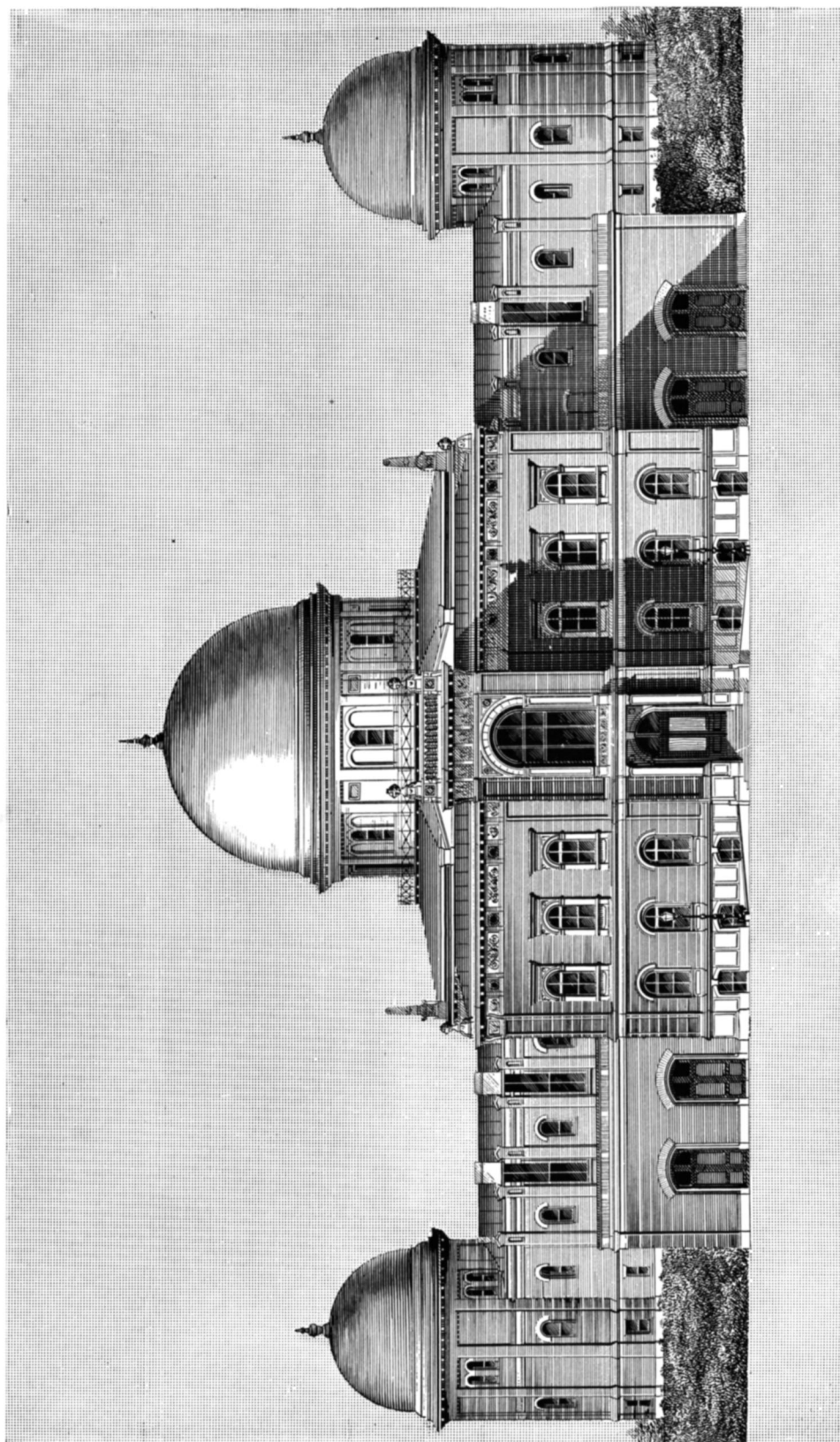
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THE IMPERIAL OBSERVATORY OF VIENNA.



NOTICES FROM THE LICK OBSERVATORY.

PREPARED BY MEMBERS OF THE STAFF.

THE IMPERIAL OBSERVATORY OF VIENNA.*

The accompanying wood cuts are copied from Lieut. WINTERHALTER'S Report on European Observatories, by the kind permission of the Superintendent of the U. S. Naval Observatory. (See *Publ. A. S. P.*, vol. III, page 40.) The short account here given is condensed from the text of Lieut. WINTERHALTER'S report and from other sources.

The old Observatory of Vienna was founded in 1756, rebuilt in 1826, and has been particularly active during the directorship of J. J. v. LITTROW (1819-1840). C. v. LITTROW (1840-77), and of Prof. WEISS.

Before 1877 C. v. LITTROW had experienced the difficulties of making precise astronomical observations in the midst of a great city, and as early as 1872 a site, comprising about 14 acres, was purchased in Währing, a suburb of Vienna, two miles from the center of the city. The buildings were commenced on a grand scale in 1874, and they were essentially finished in 1880. The new observatory is built in the form of a cross, with lengths of 330 feet north and south, and 240 feet east and west. The cut shows the south front, extending east and west. There are four domes (one being directly behind the great dome in the cut), all of which were built by Sir HOWARD GRUBB of Dublin. The meridian rooms are shown to the right and left of the great dome in the figure (two observing slits to the left, one to the right).

The great dome (which weighs about 15 tons) covers the 27-inch equatorial made and mounted by GRUBB. The east dome contains a 12-inch telescope by ALVAN CLARK & SONS; the west dome covers the 6-inch FRAUNHOFER equatorial of the old

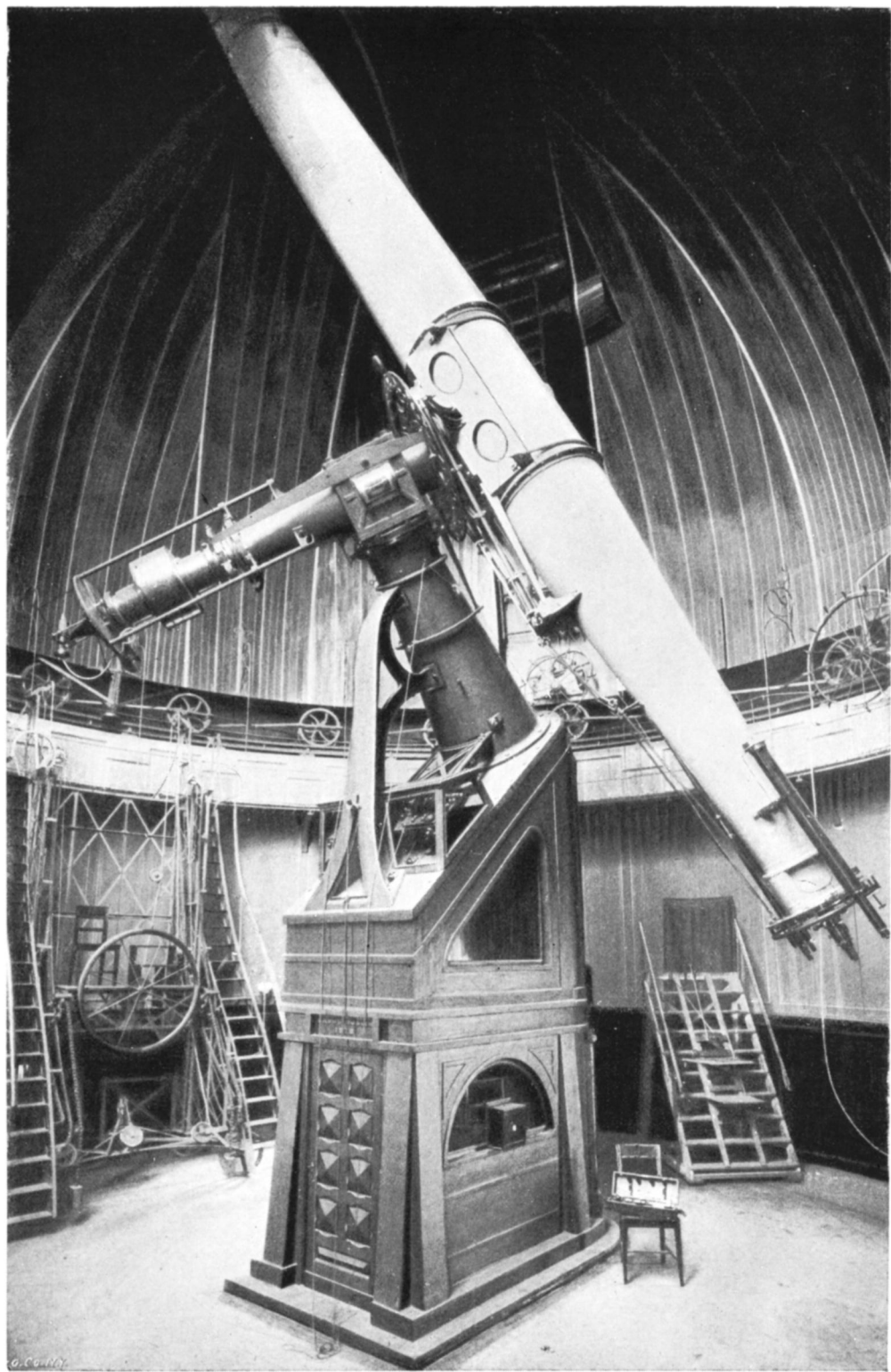
* Professor EDMUND WEISS, Director.

Vienna observatory, and the comet-seeker is placed under the north dome.

The chief instrument of the observatory, and one of the largest in the world, is the 27-inch GRUBB refractor, of which a cut is given.

Its object-glass is no doubt a good one (see Professor VOGEL'S investigations of its achromatism as quoted by Mr. KEELER in *Publ. A. S. P.*, vol. II, page 164), and great care was bestowed by the maker on the new problems presented by the mounting of so large a telescope. The general principle of the mounting can be readily understood from the figure. It is full of ingenious details, which have been fully described by the maker in *Engineering* (vol. 29, 1880). Its motions are said to be easy and satisfactory. In my opinion both this mounting and the admirable mounting of the 36-inch telescope of the Lick Observatory are too complex rather than too simple. It is only fair to say, however, that the 36-inch telescope has been in constant use since June, 1888, and that not a single night's work has been lost on account of any necessity for small repairs or adjustments. There is an undoubted convenience in being able, occasionally, to read the finely divided R. A. circle from the eye-end, for example. But how often is this required? In three years' experience at the Lick Observatory it has only been necessary to read the finely divided R. A. circle when the position of the instrument was to be determined. The cost of such an arrangement is considerable, and the adjustments are complex, and it hardly seems worth while to expend the money required, in order to spare the observer the few steps from the eye-end to the pier, where other microscopes are provided to give such readings, especially if the observer does not need to make this journey more than three or four times a year. It is more important to be able to read the declination microscopes from the eye-end, and the mechanical problem is much simpler.

The small incandescent electric lights now in use, have simplified the questions of illumination of astronomical instruments, to which so much attention has been paid by GRUBB, the REPSOLDS and others; but I think there is no doubt that it is practically more convenient to have more than one light about a telescope, than to keep in order the trains of prisms which distribute the light from a single lamp to various parts of a complex instrument, as the verniers, the microscopes, the position circle, etc.



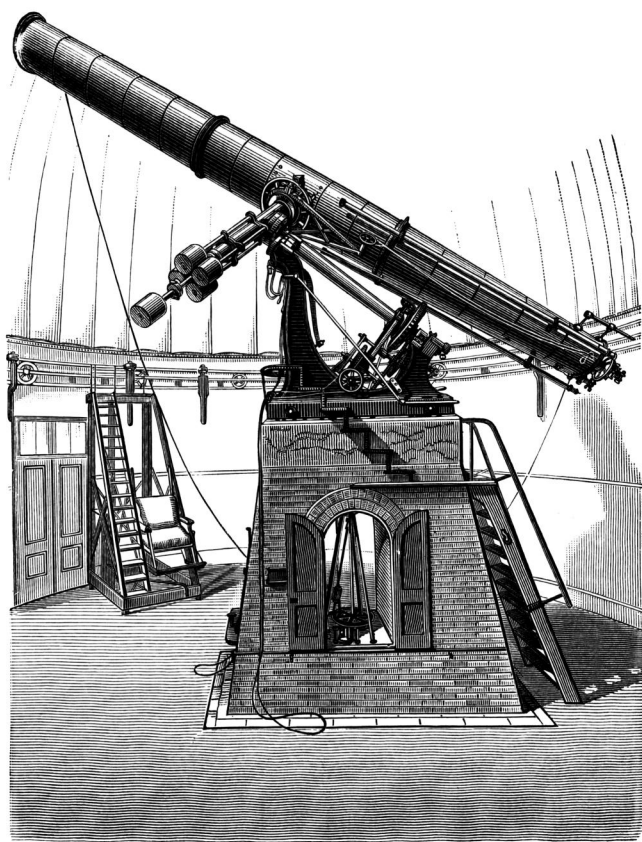
THE 27-INCH GRUBB EQUATORIAL OF VIENNA.

My own experience with large and small equatorials (and with the disposition of a limited amount of money to provide for practically unlimited wants) has led me to the conclusion that some change in the ideals of instrument makers should be made. The real question is, not to solve in the best manner a certain number of complex mechanical problems, but it is to use a certain sum of money so as to produce a perfectly satisfactory instrument for practical use, and to save everything in first cost that can properly be saved. Everything saved in first cost can be utilized in endowment, and the main point in an observatory is that its instruments shall be kept in constant use, for which purpose observers are needed. Any slighting of the essentials of an instrument is unpardonable. Any unnecessary elaboration of the details is, on the other hand, useless. Although large telescopes (as, for instance, the 36-inch equatorial) have been made so that they can easily be operated by a single observer, I question whether this is a truly economical plan to follow. Two observers will always do very much more work than one, and in many cases they will do more than twice as much as one. Hence, it seems to me that true economy in designing large instruments (either equatorials or meridian circles) is to put all the expense of time and money on the essential features (the bearings of the axes, the driving clock, etc., etc.), and to cut off every unnecessary appliance. The money thus saved will pay the salary of an intelligent aid. With a large equatorial, for example, it is necessary to be able to set the telescope quickly upon an object. Ninety-nine times in a hundred that object can at once be recognized in the finder, or, at least, in a low-power eye-piece on the main instrument (a double star, a comet, a nebula, for example). A setting to the nearest $10'$ in Decl. and 1^m in R. A., suffices for the vast majority of cases like these, and such a setting can readily be made on coarse painted circles divided to 1° in Decl. and 5^m in R. A. I doubt if Mr. BURNHAM has used any circles but our coarse circles during the whole time of his connection with the Lick Observatory, and he has found and pointed on thousands of double stars. If it is necessary to identify an object which is too faint to be distinguished in the finder, the quickest method will always be to make a small sketch map from a star chart. With this chart in hand the telescope can be *accurately* set in Decl. from the eye-end and to the nearest 0.5^m in R. A. by the coarse hour circle. A very little sweeping in R. A. with the low-power eye-piece

brings the configuration of stars into the center of the field. The fine R. A. circle does not need to be read with large instruments, unless in very exceptional instances. The principles which govern in these cases, also obtain in many others. To read a vernier it is essential to have a beam of light fall in a given direction. It is often very much easier (and far less expensive) to make a little stand on which a hand lamp can be set, when necessary, than to provide and adjust a train of optical prisms which shall take a beam from a single lamp, divide it into separate beams, and turn these round various corners, and finally deliver *sufficient* light at a point thirty feet away from the original source. Such mechanical and optical problems have been solved with great ingenuity by Sir HOWARD GRUBB, the REPSOLDS, WARNER and SWASEY, and many other artists, but, in quite a number of instances, at least, it has been a mechanical, and not an astronomical, problem, that has been attacked.

For large instruments the services of an assistant are required, and if such services are available there is no necessity for some of the more refined mechanical devices. When the equatorial is of moderate dimensions (10, 12, 16 and 20 inches in aperture) then every possible convenience should be provided, for the services of an assistant are seldom available or necessary. A telescope as large as the Princeton equatorial (23-inch aperture) really requires an assistant to aid the observer, especially in delicate work, like spectroscopy. The same principle governs with meridian instruments. With the smaller circles (4, 5 inches) one observer is sufficient. With the larger instruments (7, 8, 9 inches, for example), it is a positive economy to have two observers work together, one at the telescope, the other at the microscope.

I have taken this occasion to speak of these matters because it appears to me to be a very important thing to limit and define the ideal of the artist who makes the instrument (and who, more or less, is solving purely mechanical problems) by the experience of the observer who is willing to take the necessary pains to secure a satisfactory result. And these remarks must be understood to apply chiefly to instruments of large dimensions, where the services of a skilled assistant are required in any event, and where such services can be utilized to do away with the necessity (and with the cost) of complex devices of one kind and another. The real test of a device is whether it is actually used, not whether it might be used; or, rather, whether one could not easily do without it.



EL. ANAGET

THE 26-INCH CLARK EQUATORIAL OF WASHINGTON.

The large telescope at Vienna has made important observations of comets too faint to be seen with smaller instruments, as well as asteroid observations of the same kind. Experiments have been made in photographing with it, and these are still in progress. A list of double stars has also been observed.

For comparison, or rather contrast, with its mounting, I insert a cut of the 26-inch telescope at Washington, which we owe to the courtesy of Captain MCNAIR, Superintendent of the Observatory. The mounting is by ALVAN CLARK & SONS, and is too light and too simple, rather than the reverse. It has, however, served its purposes admirably, for the past seventeen years, in the skillful hands of Professors NEWCOMB and HALL.

The 12-inch CLARK telescope at Vienna has been employed in the discovery and observation of asteroids in the completion of PALISA's Ecliptic Charts and in comet observations. This object-glass is a very fine one in every respect.

The Observatory possesses a REICHENBACH meridian circle, made in 1825, and a 5-inch prime vertical transit by STARKE, also very old. Its present equipment of meridian instruments is thus very defective, as compared to its admirable outfit of equatorials. The Observatory has regularly published its observations since 1821.

E. S. H.

LIST OF EARTHQUAKES IN CALIFORNIA DURING THE
YEAR 1890.

The following list contains the dates and places of occurrence of earthquakes in California (and occasionally in Nevada and Alaska) during the past year. It is a continuation of the list printed in Number 7 of these *Publications*, giving the same data for the year 1889. A complete description of the different shocks will be printed in the form of a bulletin by the U. S. Geological Survey. The times are Pacific Standard Times. The Roman numerals indicate the estimated intensity of the shocks on the ROSSI-FOREL scale:

List of Earthquakes.

1890.

- January 2, 8;15—Kodiak Island, Alaska.
- January 11, 4:20 A. M.—Kodiak Island, Alaska.
- January 15, 5:05 A. M.—Mt. Hamilton (IV-V).
- January 18, 3:30 P. M.—Santa Barbara, Napa.
- January 23, 4:18 A. M.—Oakland.